September 30, 1960

Dr. Peter Walker
Department of Zoology
West Mains Road
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Edinburgh 9, Scotland

Dear Doctor Walker:

My thanks for the reprints and for your letter of July 19th, all of which I have been digesting over the summer. I do appreciate your offer of help and hope to seek your advice, especially as our project seems to be converging even closer to your own recent technical interests. During the past couple of months, my own views as to the best direction of the program have altered slightly - some of the reasons for this are summarized in the accompanying reports. I am happy to send these to you on a personal basis; there is nothing officially restricted in them but I would be rather embarrassed if they were published without careful review. The main point is that the most useful aspect of ultraviolet would, of course, be a spectrum and not merely an absorption image at a single wave length. In fact, it is a reasonable supposition that any object that can be seen under phase contrast would also scatter sufficiently to give some sort of image in the ultraviolet. In the end we would still have to make at least a rudimentary comparison of absorption at two or more wavelengths. On the other hand, it seems much simpler to drive one's image information by phase contrast microscopy, or perhaps interference microscopy, and to concentrate on using the ultraviolet for spectral rather than image purposes. This would entail setting up a microspectrophotometer which could rapidly scan individual particles as they passed the aperture; those particles which gave an interesting spectrum, i.e. which have a zero in the first or second derivatives of absorption with respect to wave length, might then be photographed and the signal for the image and the associated spectrum telemetered back to earth. Casperson thinks that with the new lenses, it might be just possible to make this scheme work, though there may be formidable difficulties on account of energy limitations and scattering by the particle. Your own comments on this would be appreciated. I had in mind that we might look into the possibility of using a quartz fiber terminating in a tip of just under one micron diameter as the condenser and collecting all of the light which passed through the specimen as far as this is possible with the available optics. I have not made any calculations as yet on the plausible energy values available from existing light sources and the sensitivity of useful

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photodetectors, factors which obviously would control the scanning rate. For this to be useful, we should have a quite rapid scan.

As one approach to the depths of the problem, I thought we might look into rapid scanning for UV spectra on a macro scale but there seems to have been more work in the infrared than in other regions. Do you know of the existing literature on such instrumentation? Are you acquainted with any commercially available instruments for spectral display on the CRO? I understand that the American Optical Company has done something along these lines for the visible spectra and I am writing them accordingly.

It might seem to you that these plans are premature in relation to realistic expectations for planetary flight. As you probably know, the U.S. planetary program will be based on the Saturn vehicles whose developmental flights are scheduled for 1964. It would be an additional few years before we might realistically hope to plant one of these experiments on Mars. However, there is a tremendous amount of lead time required for the mutual adaptation of the space craft and the instruments; consequently our margins of time are not comfortable at all. This spectromicroscope project is intended as the work horse of these definitive flights; we are also working on some less ambitious techniques as a back stop and also for possible use of earlier missions with available vehicles.

Are you likely to find yourself in this country at any time during the next year? If so, I would welcome the opportunity that it might afford for us to get together. Failing this, I will probably be coming over next April and if there is any possibility of it, I would be very pleased to take the opportunity to visit you (and of course, my many other friends) at Edinburgh.

Yours sincerely,

Joshua Lederberg
Professor of Genetics

P.S. There is one particular thing you could probably do for me at much less effort than it would take me: a complete listing of specific references to ultraviolet spectra of cells and other particles obtained by photoelectric recording and through a microscope.

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